

WHAT IS CLAIMED IS:

1. A method for manufacturing a long resin molding having an axial bend, comprising:

supplying a resin molding material in heated and molten state extruded from an extrusion die to a sizing flow channel of a sizing equipment;

solidifying the resin molding material by cooling from outside within the sizing flow channel to calibrate the resin molding into a predetermined cross sectional shape;

extruding the resin molding of the predetermined cross sectional shape from an exhaust port of the sizing flow channel at a constant extrusion direction and a constant angle carriage and in a state capable of plastic deformation;

supplying continuously the resin molding to a molding gripping portion of a bender disposed on the downstream side of an exhaust port of the sizing equipment, the gripping portion slidably gripping the resin molding; and

performing an axial bending process for the resin molding when the resin molding passes through the gripping portion by disposing the gripping portion at a position so as to orient in a direction crossing the constant extrusion direction.

2. The manufacturing method according to claim 1,

wherein the step of performing the axial bending process includes performing the axial bending process while keeping

a part of the resin molding to be processed in a condition where the temperature of the inside is higher than the temperature on the outer surface of the resin molding.

5     3.     The manufacturing method according to claim 2,  
          wherein the keeping step includes keeping the part of  
the resin molding to be processed in a condition where the  
temperature on the outer surface is lower than the heat  
distortion temperature of the resin molding material composing  
10 the resin molding, and keeping the temperature of the inside  
of the part of the resin molding higher than or equal to the  
heat distortion temperature of the resin molding material and  
lower than the melting temperature.

15     4.     The manufacturing method according to claim 1,  
          wherein the step of performing the axial bending process  
includes performing a bending process for one part of the resin  
molding in the longitudinal direction of the axial line at a  
different radius of curvature from the other part by changing  
20 the position of the gripping portion in accordance with a length  
of the resin molding passing through the gripping portion.

5.     The manufacturing method according to claim 1, further  
comprising: applying a force on the resin molding in the same  
25 direction as the extrusion direction on the downstream side

of the exhaust port of the sizing equipment and the upstream side of the gripping portion to cause the force to act as a pulling force of the resin molding from the sizing flow channel and a pushing force of the resin molding to the gripping portion.

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6. The manufacturing method according to claim 1, further comprising compulsorily cooling the resin molding from the outer surface with a coolant at least after the middle of the bending processing.

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7. The manufacturing method according to claim 1, the solidifying step includes cooling the resin molding material from the outer surface within the sizing flow channel so that the outer surface of the resin molding has a lower degree of  
15 crystallinity than the inside, the resin molding material being a material containing crystalline resin as the main component.

8. The manufacturing method according to claim 1, further comprising detecting an extrusion length of the resin molding,  
20 and cutting off the resin molding after the bending processing on the downstream side of the gripping portion, when the extrusion length reaches a predetermined length.

9. The manufacturing method according to claim 1, wherein  
25 the gripping portion performs at least two of the following

operations,

(a) changing the position in a first direction crossing the extrusion direction,

(b) changing the position in a second direction crossing at right angle to the first direction, and

(c) changing the angle carrier.

10. A method for manufacturing a long resin molding having an axial twist, comprising:

10 supplying a resin molding material in heated and molten state extruded from an extrusion die to a sizing flow channel of a sizing equipment;

solidifying the resin molding material by cooling from outside within the sizing flow channel to calibrate a resin molding into a predetermined cross sectional shape;

15 extruding the resin molding of the predetermined cross sectional shape from an exhaust port of the sizing flow channel at a constant extrusion direction and a constant angle carriage and in a state capable of plastic deformation;

20 supplying continuously the resin molding to a molding gripping portion of a bender disposed on the downstream side of an exhaust port of the sizing equipment, the gripping portion slidably gripping the resin molding; and

performing an axial twisting process for the resin molding when the resin molding passes through the gripping portion by

disposing the gripping portion in a carriage different from the constant angle carriage.

11. An apparatus for manufacturing a long resin molding having  
5 at least one of an axial bend and an axial twist, comprising:

an extrusion die having heating means for heating a resin molding material and an orifice for extruding the molding material into a predetermined cross sectional shape;

a sizing equipment having a sizing flow channel, connected  
10 to the extrusion die, for cooling from the outer surface and solidifying the resin molding material in heated and molten state extruded from the die to calibrate a resin molding into a predetermined cross sectional shape, and extruding the resin molding from an exhaust port at a constant extrusion direction  
15 and a constant angle carriage, and a cooling unit for cooling the sizing flow channel;

a bender having a gripping portion, which is disposed on the downstream side of the sizing equipment, for slidably gripping the resin molding supplied continuously from the sizing  
20 equipment; and

a driving mechanism connected to the gripping portion;

wherein the driving mechanism is capable of changing at least one of an orientation and an angle carriage of the gripping portion so as to be different than the constant extrusion  
25 direction and the constant angle carriage.

12. The manufacturing apparatus according to claim 11,  
further comprising: a pulling machine for applying a force on  
the resin molding in the same direction as the extrusion  
5 direction to cause the force to act as a pulling force of the  
resin molding from the sizing flow channel and a pushing force  
of the resin molding to the gripping portion;

wherein the pulling machine is disposed on the downstream  
position of the exhaust port of the sizing equipment and the  
10 upstream position of the gripping portion.

13. The manufacturing apparatus according to claim 11,  
further comprising: a length detector for detecting an extrusion  
length of the resin molding;

15 wherein the length detector is disposed on the downstream  
position of the exhaust port of the sizing flow channel; and

an operation of the driving mechanism is controlled in  
accordance with a signal from the length detector.

20 14. The manufacturing apparatus according to claim 13,  
further comprising: a pulling machine for applying a force on  
the resin molding in the same direction as the extrusion  
direction to cause the force to act as a pulling force of the  
resin molding from the sizing flow channel and a pushing force  
25 of the resin molding to the gripping portion;

wherein the pulling machine is disposed on the downstream position of the exhaust port of the sizing equipment and the upstream position of the gripping portion; and

the length detector is connected to the pulling machine  
5 so that the operation of the driving mechanism is controlled in accordance with a pulled out length detected by the detector.

15. The manufacturing apparatus according to claim 11,  
further comprising: a coolant supply device that supplies a  
10 coolant for compulsorily cooling the resin molding extruded through the exhaust port from the outer surface;

wherein the resin molding is disposed on the downstream side of the exhaust port of the sizing flow channel.

15 16. The manufacturing apparatus according to claim 11,  
further comprising: a cutting-off machine for cutting off the resin molding into a predetermined length;

wherein the cutting-off machine is provided on the downstream side of the gripping portion.

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17. A method for manufacturing a long molding having an axial bend along a longitudinal direction, comprising:

forming a long first member capable of plastic deformation continuously in the longitudinal direction, by employing a first  
25 member molding unit, the long first member having a predetermined

cross sectional shape, and having a constant radius of curvature and a constant angle carriage on the axial line in the longitudinal direction;

performing an axial bending process for the first member,  
5 when the first member passes through a first member gripping portion, in which the first member is supplied continuously to the first member gripping portion of a bender disposed on the downstream side of the first member molding unit, and slidably gripped by the gripping portion, and the gripping  
10 portion is disposed at a position in a direction crossing a supply direction of the first member;

causing the first member passing through the gripping portion to pass through an extrusion die provided near the gripping portion and at a position corresponding to an axial  
15 position passing through the gripping portion; and

extruding a heated and molten liquid resin molding material for formation of a second member through an orifice of the extrusion die while following a bend of the first member to integrate the second member made of the molding material  
20 and having a predetermined cross sectional shape with the first member.

18. The manufacturing method according to claim 17,  
wherein the step of performing the axial bending process  
25 includes performing a bending process for one part of the first



member passing through the gripping portion in the longitudinal direction at a different radius of curvature from the other part by changing the position of the gripping portion or the extrusion die in accordance with a length of the first member  
5 passing through the gripping portion; and

the extruding step includes integrating the second member extruded through the orifice with the first member along a longitudinal direction of the processed first member.

10 19. The manufacturing method according to claim 17,  
wherein the gripping portion performs at least two of the following operations,

(a) changing the position in a first direction crossing the direction of supplying the first member,

15 (b) changing the position in a second direction crossing at right angle to the first direction, and

(c) changing the angle carrier.

20 20. The manufacturing method according to claim 17, further comprising: detecting a supply length of the first member; and changing the position of the gripping portion or the extrusion die under a control in accordance with a predetermined program, when the supply length reaches a predetermined length.

- 25 21. The manufacturing method according to claim 17, further

comprising: compulsorily cooling and solidifying the second member after integrating the second member with the first member.

22. The manufacturing method according to claim 17,

5        wherein the step of forming a long first member includes:  
roll forming a metallic strip material by the first member  
molding unit, and forming continuously the first member having  
the predetermined cross sectional shape in the longitudinal  
direction.

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23. A method for manufacturing a long molding having an axial  
twist along a longitudinal direction, comprising:

forming a long first member capable of plastic deformation  
continuously in the longitudinal direction, by employing a first  
15 member molding unit, the long first member having a predetermined  
cross sectional shape, and having a constant radius of curvature  
and a constant angle carriage on the axial line in the  
longitudinal direction;

performing an axial twisting process for the first member,  
20 when the first member passes through a first member gripping  
portion, in which the first member is supplied continuously  
to the first member gripping portion of a bender disposed on  
the downstream side of the first member molding unit, and  
slidably gripped by the gripping portion, and the gripping  
25 portion is disposed at a carriage different from the constant

angle carriage;

causing the first member passing through the gripping portion to pass through an extrusion die provided near the gripping portion and at a carriage corresponding to an angle carriage of the first member passing through the gripping  
5 portion; and

extruding a heated and molten liquid resin molding material for formation of a second member through an orifice of the extrusion die while following a twist of the first member  
10 to integrate the second member made of the molding material and having a predetermined cross sectional shape with the first member.

24. An apparatus for manufacturing a long molding having at  
15 least one of an axial bend and an axial twist along a longitudinal direction, comprising:

a first member forming unit for forming a long first member capable of plastic deformation continuously in the longitudinal direction, the long first member having a predetermined cross  
20 sectional shape, and having a constant radius of curvature and a constant angle carriage on the axial line in the longitudinal direction;

a bender having a gripping portion, which is disposed on the downstream side of the first member forming unit, for  
25 slidably gripping the first member supplied continuously from

the first member forming unit, and a movement mechanism for moving at least one of an orientation and an angle carriage of the gripping portion so as to be different than the constant extrusion direction and the constant angle carriage; and

5           an extrusion die having an insertion hole into which the first member is inserted and an orifice through which a second member having a predetermined cross sectional shape is extruded from a liquid resin molding material for formation of the second member in heated and molten state, the extrusion die being  
10       disposed near the gripping portion to cooperate with the arrangement of the gripping portion.

25.   The manufacturing apparatus according to claim 17, further comprising: an extrusion machine; and

15           a flexible pipe having heating means;  
          wherein the extrusion die is connected to the extrusion machine via the flexible pipe; and

          the resin molding material for formation of the second member extruded in heated and molten state from the extrusion  
20       machine is supplied via the flexible pipe to the extrusion die.

26.   A method for manufacturing a long molding having an axial bend along a longitudinal direction, comprising:

          forming a long first member capable of plastic deformation  
25       continuously in the longitudinal direction, by employing a first

member forming unit, the long first member having a predetermined cross sectional shape, and having a constant radius of curvature and a constant angle carriage on the axial line in the longitudinal direction;

5 performing an axial bending process for the first member, when the first member passes through a gripping portion, in which the first member is supplied continuously to the gripping portion of a bender disposed on the downstream side of the first member forming unit, and slidably gripped by the gripping portion,  
10 and the gripping portion is disposed at a position in a direction crossing a supply direction of the first member;

causing the first member passing through the gripping portion to pass through a second member extrusion die provided near the gripping portion and at a position corresponding to  
15 an axial position of the first member passing through the gripping portion; and

extruding a heated and molten liquid resin molding material for formation of a second member through a second member molding opening of the second member extrusion die while  
20 following a bend of the first member to integrate the second member made of the molding material with the first member;

wherein the second member extrusion die has a substantially changeable opening shape of the second member molding opening; and the second member having a different cross  
25 sectional shape between one part and the other part in the

longitudinal direction is extruded in accordance with a change of the opening shape by changing the opening shape at a predetermined timing in extruding the second member.

5 27. The manufacturing method according to claim 26,  
wherein the opening shape of the second member molding opening is changed in accordance with the length of the first member passing through the gripping portion.

10 28. The manufacturing method according to claim 26, further comprising: detecting a supply length of the first member, and changing the position of the gripping portion or the extrusion die under a control in accordance with a predetermined program, when the supply length reaches a predetermined length.

15 29. The manufacturing method according to claim 26, further comprising: detecting the supply length of the first member; and changing the opening shape of the second member molding opening under the control in accordance with a predetermined  
20 program, when the supply length reaches a predetermined length.

30. The manufacturing method according to claim 26, further comprising: compulsorily cooling and solidifying the second member after integrating the second member with the first member.

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31. A method for manufacturing a long molding having an axial twist along a longitudinal direction, comprising:

forming a long first member capable of plastic deformation continuously in the longitudinal direction, by employing a first member forming unit, the long first member having a predetermined cross sectional shape, and having a constant radius of curvature and a constant angle carriage on the axial line in the longitudinal direction;

performing an axial twisting process for the first member, when the first member passes through a gripping portion, in which the first member is supplied continuously to the gripping portion of a bender disposed on the downstream side of the first member molding unit, and slidably gripped by the gripping portion, and the gripping portion is disposed at a carriage different from the constant angle carriage;

causing the first member passing through the gripping portion to pass through a second member extrusion die provided near the gripping portion and at a carriage corresponding to an angle carriage of the first member passing through the gripping portion; and

extruding a heated and molten liquid resin molding material for formation of a second member through a second member molding opening of the second member extrusion die while following a twist of the first member to integrate the second member made of the molding material with the first member;

wherein the second member extrusion die has a substantially changeable opening shape of the second member molding opening; and the second member having a different cross sectional shape between one part and the other part in the longitudinal direction is extruded in accordance with a change of the opening shape by changing the opening shape at a predetermined timing in extruding the second member.

32. An apparatus for manufacturing a long molding having at least one of an axial bend and an axial twist along a longitudinal direction, comprising:

a first member molding unit for forming a long first member capable of plastic deformation continuously in the longitudinal direction, the long first member having a predetermined cross sectional shape, and having a constant radius of curvature and a constant angle carriage on the axial line in the longitudinal direction;

a bender having a gripping portion, which is disposed on the downstream side of the first member molding unit, for slidably gripping the first member supplied continuously from the first member molding unit, and a movement mechanism for moving at least one of an orientation and an angle carriage of the gripping portion so as to be different than the constant extrusion direction and the constant angle carriage; and

a second member extrusion die having an insertion hole



into which the first member is inserted and a second member molding opening through which a second member is extruded from a liquid resin molding material for formation of the second member in heated and molten state, the second member extrusion die being disposed near the gripping portion to cooperate with the arrangement of the gripping portion;

wherein the second member extrusion die is provided with opening shape changing means for substantially changing opening shape of the second member molding opening at a predetermined timing.